

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS

1 1. (Currently Amended) ~~High-speed~~ In a method of
2 depositing diamond films from ~~the~~ a gaseous phase in ~~the~~ a
3 plasma of a microwave discharge, when the microwave
4 discharge is formed in ~~the~~ a gaseous mixture placed in ~~the~~ a
5 reaction chamber and ~~consisting of~~ comprising at least
6 hydrogen and hydrocarbon, wherein the said gaseous mixture
7 is activated by means of a microwave discharge to form
8 atoms of hydrogen and carbon-containing radicals, and the
9 latter are deposited on the substrate and form a
10 polycrystalline diamond film as the result of surface
11 reactions, ~~which differs in that~~ the improvement which
12 comprises:

13 ~~activating~~ the said gaseous mixture ~~is activated~~
14 ~~by means of increasing so as to increase~~ a density of
15 electrons, Ne, in the plasma by means of creating ~~a~~ stable,
16 non-equilibrium plasma with ~~its~~ a power at least 1 kW and
17 frequency f that exceeds ~~by far~~ the ~~a~~ frequency of 2.45
18 GHz, ~~which is used commonly,~~ in the reaction chamber, ~~and,~~
19 in order to localize the plasma, as a standing wave

20 microwave with nodes near the substrate is formed and at
21 its nodes plasma layers with the possibility to control
22 their dimensions as a layer over the substrate which plasma
23 is are generated and maintained by microwave beams directed
24 at and converging on the standing microwave so as to
25 deposit diamond film on the substrate.

1 2. (Currently Amended) ~~High-speed~~ The method as described
2 ~~in par. 1, of Claim 1~~ which differs in that the wherein
3 said gaseous mixture is activated by means of increasing
4 electron density N_e by using electromagnetic radiation with
5 its frequency f equal to 30 GHz, and the dimensions of the
6 plasma layers in the nodes of the standing microwave are
7 controlled by changing the profiles and size of ~~the a~~
8 transverse cross-section of the crossing wave beams that
9 form the standing wave.

1 3. (Currently Amended) ~~High-speed~~ The method as described
2 ~~in par. 1 or par. 2, of Claim 1 or 2 wherein which differs~~
3 ~~in that four or more of the~~ wave beams that are crossed
4 pairwise are used to form the standing wave.

1 4. (Currently Amended) ~~High-speed~~ The method as described
2 in par. 1 or par 2, of Claim 1 or 2 wherein which differs
3 in that two converging crossing wave beams are used to form
4 the standing wave.

1 5. (Currently Amended) ~~High-speed~~ The method as described
2 in par. 1 or par. 2, of Claim 1 or 2 wherein which differs
3 in that two converging opposite wave beams are used to form
4 the standing wave.

1 6. (Currently Amended) ~~High-speed~~ The method as described
2 in par. 1 or par. 2, of Claim 1 or 2 wherein which differs
3 in that the wave beam is incident on the substrate and the
4 wave beam is reflected from the substrate ~~are used~~ to form
5 the standing wave.

1 7. (Currently Amended) ~~Plasma A~~ reactor system for ~~high-~~
2 speed deposition of diamond films from ~~the a~~ gaseous phase
3 in ~~the a~~ plasma of a microwave discharge, which system
4 contains a microwave generator, a transmission line ending
5 with a quasi-optical electrodynamic system, a reaction
6 chamber with a substrate on a substrate holder placed in ~~it~~
7 the chamber, and a system for pump-in and pump-out of the
8 selected gaseous mixture, ~~which differs in that the the~~

9 improvement which comprises a quasi-optical electrodynamic
10 ~~system is made and installed such as to make it possible to~~
11 adapted to form a standing microwave in ~~the~~ an area
12 selected in ~~the~~ a vicinity of the substrate, and the
13 transmission line is ~~made as~~ an oversized circular
14 waveguide with corrugation of its internal surface, which
15 is supplemented with a mirror system to transfer at least
16 one Gaussian beam to the said quasi-optical electrodynamic
17 system.

1 8. (Currently Amended) ~~Plasma~~ The reactor as described in
2 par. 7, system of Claim 7 which differs in that wherein the
3 quasi-optical system ~~is made of~~ has four mirrors situated
4 on different sides relative to ~~the~~ a region of plasma
5 formation and ~~installed in order to make it possible to~~
6 direct the microwave radiation as four wave beams, wherein
7 the crossing is pairwise, and wherein the
8 quasi-electrodynamic system together with a part of the
9 transmission line are installed within the reaction
10 chamber, and wherein the transmission line is supplemented
11 with a divider, which divides one wave beam into four beams
12 and is installed at ~~the~~ an output of the said oversized
13 circular waveguide.

1 9. (Currently Amended) ~~Plasma~~ The reactor as described in
2 ~~par. 7, system of Claim 7 wherein which differs in that the~~
3 quasi-optical system is made of two mirrors situated on
4 different sides relative to ~~the a~~ region of plasma
5 formation and installed in order to make it possible
6 positioned so as to direct the two beams of the microwave
7 radiation at small angles to ~~the a~~ substrate surface of the
8 substrate, and the transmission line is supplemented with
9 a divider, which divides one wave beam into two beams and
10 is installed at ~~the an~~ output of the said oversized
11 circular waveguide.

1 10. (Currently Amended) ~~Plasma~~ The reactor system as
2 ~~described in par. 7, of Claim 7 wherein which differs in~~
3 ~~that the~~ a quasi-optical system is made of two mirrors
4 situated on different sides relative to ~~the~~ a region of
5 plasma formation and ~~installed in order to make it possible~~
6 positioned so as to direct the wave beams opposite to each
7 other, and wherein one of the two mirrors is installed so
8 as to be movable forward and backward parallel to itself to
9 ~~the~~ a distance of $\pm\lambda/4$, where λ is microwave radiation
10 wavelength, and wherein the transmission line is
11 supplemented with a divider, which divides one wave beam
12 into two beams and is installed at ~~the~~ an output of the
13 said oversized circular waveguide.

1 11. (Currently Amended) ~~Plasma~~ The reactor system as
2 ~~described in par. 7, of Claim 7 wherein which differs in~~
3 ~~that the~~ a bottom part of the reaction chamber has a
4 dielectric window to inject microwave radiation, and the
5 substrate is installed in ~~the~~ a top part of the chamber
6 opposite to the window, and wherein the quasi-optical
7 electrodynamic system is made as one mirror situated out of
8 and lower than the ~~said~~ reaction chamber so as to make it
9 possible to direct ~~the~~ a microwave beam upwards
10 perpendicular to the substrate surface.

1 12. (Currently Amended) ~~Plasma~~ The reactor system as
2 described in par. 7, of Claim 7 wherein which differs in
3 that the quasi-optical electrodynamic system is made as has
4 one mirror installed so as to ~~make it possible to direct~~
5 the a microwave beam with normal incidence to ~~the a~~
6 substrate surface of the substrate or at a low angle to ~~the~~
7 normal, and a cooled radioparent wall is installed in the
8 reaction chamber, which wall is ~~made as~~ a grating of thin
9 cooled metal tubes or rods and is installed parallel to the
10 surface of the substrate at ~~the a~~ distance longer than $\lambda/2$
11 from the- substrate.

1 13. (Currently Amended) ~~Plasma~~ The reactor system as
2 described in par. 7, of Claim 7 wherein which differs in
3 that the quasi-optical electrodynamic system is made has as
4 a mirror and a quasi-optical resonator with plane-parallel
5 mirrors set at ~~the a~~ distance multiple of $\lambda/2$, which
6 resonator is coupled with the electrodynamic system, and
7 wherein one of the resonator mirrors is a surface of the
8 substrate on the substrate holder, and the other mirror ~~is~~
9 made as comprises a periodic grating of thin metal tubes or
10 rods, wherein a and ~~the~~ grid period of the grid is less
11 than λ .

1 14. (Currently Amended) ~~Plasma~~ The reactor system as
2 described in par. 8 or par 9, or par. 10, of any one of
3 Claims 8, 9 or 10 wherein which differs in that the a
4 system for pumping gas into the reaction chamber into the
5 region of the plasma formation is ~~made~~ as a concave metal
6 screen with a feeding tube in ~~its~~ a central part, and ~~this~~
7 the screen is situated over the substrate holder at an
8 adjustable distance, and the system for pumping the gas out
9 is made as a set of apertures in the substrate support,
10 which has ~~some~~ a volume for the evacuated gas mixture, and
11 in this volume the system for water cooling of the upper
12 part of the substrate support is situated.

1 15. (Currently Amended) ~~Plasma~~ The reactor system as
2 described in part. 12 or par. 13, of Claim 12 or 13 wherein
3 which differs in that the a system for pumping the ~~selected~~
4 gas mixture in is combined with the grating ~~made of~~ which
5 is thin cooled metal tubes, and wherein the system for
6 pumping the gas out is ~~made~~ as a set of apertures in the
7 substrate holder, which has ~~some volume~~ a portion for the
8 evacuated gas mixture, and in this volume the ~~system~~ a
9 portion for water cooling of the an upper part of the
10 substrate holder ~~is situated~~.